

REMARKS

This preliminary amendment is being filed in conjunction with a Rule 1.132 Inventor Declaration ("the Declaration") of inventor James Bryer. Claims 6-9 have been cancelled. Claim 10 has been amended to depend from claim 1, in view of the cancelled claims. New claims 16-20 have been added. Thus, claims 1-5 and 10-20 are now pending in the application.

The pending claims are directed to methods for removing metallic contamination from a wafer container (or box) using a solution including a chelating agent. Claims similar to the pending claims were finally rejected, in a June 24, 2003 Final Office Action, in parent case serial no. 10/224,625. Of the references cited against the claims in the parent case, only Sugihara et al. and Woolsey et al. teach the use of chelating agents, and neither reference teaches or suggests using a chelating agent for removing metallic contamination from a wafer container, as claimed.

Sugihara et al. discloses an immersion process in which semiconductor substrates are dipped into a cleaning fluid containing a phosphonic acid chelating agent, in order to remove metals from the substrates (see Examples 1-19). By teaching an immersion cleaning process for substrates, however, Sugihara et al. does not suggest that a chelating agent could effectively be used to remove metallic contamination from a wafer container in a spray process (see Declaration, paragraphs 6-7, explaining that it was previously thought that chelating agents would not be useful in removing metals from wafer boxes; see also Declaration paragraph 10, stating that "due to the differences in materials, surface conditions, contamination characteristics,

and size and shape, between wafers and boxes, there is no reason to believe that techniques used for cleaning wafers, as in Sugihara et al., could also successfully be used for cleaning boxes”).

Indeed, it was unexpected that a chelating agent would actually be effective at removing metal contamination from a wafer container (see Declaration paragraphs 6-8, wherein inventor Bryer explains that an Applications engineer at Aldrich Chemical Co. explained to him that chelating agents “act like a glove” to prevent metal molecules from adhering or depositing onto the surfaces of an immersed wafer, but that chelating agents would not be useful in actually removing metals from boxes). Thus, when tests showed that a chelating agent solution, when used in a spray process, could successfully remove metal contamination from wafer boxes, the results were unexpected (see Declaration, paragraph 8). Accordingly, it would not have been obvious to one skilled in the art to modify an immersion process that uses a chelating agent to clean a wafer, such as that taught by Sugihara et al., into a spray process, in order to remove metal contamination from a wafer container, as it was thought at the time of the invention that a chelating agent would not effectively remove metal from a wafer container.

In response to the assertion that immersing is functionally equivalent to cleaning by spraying, Applicants submit that this is clearly not the case when cleaning a wafer container (see Declaration, paragraphs 4-6). This is so because wafer containers are relatively large and would require high volumes of cleaning fluid to be adequately cleaned in an immersion process (see Declaration, paragraph 4). Cleaning fluids used

in the semiconductor industry are typically expensive to use and dispose of (see Declaration, paragraph 5). Thus, it is extremely desirable to minimize the amount of cleaning fluid used to clean the wafer containers, and an immersion process would require much more cleaning fluid than a spraying process.

Additionally, immersion or dipping processes used to clean semiconductor wafers typically require large processing tanks, which take up a significant amount of space. Such large tanks are generally undesirable in a clean room environment where wafers are cleaned, and where space is at a premium. An immersion tank used to clean wafer containers would likely be much larger than immersion tanks used to clean wafers (see Declaration, paragraph 4), since wafer containers are necessarily larger than the wafers themselves. Thus, an immersion tank used to clean wafer containers would occupy even more of the limited space in a clean room. Accordingly, Sugihara et al., which teaches immersion of semiconductor substrates in a chelating agent solution, does not suggest the very different process of spraying a wafer container with a chelating agent solution to remove metallic contamination from the wafer container.

Sugihara et al. also states that attempts have previously been made to decrease the amount of metal impurities adhering to semiconductor substrates by using a chelating agent, such as EDTA, but that the addition of the chelating agent gave almost no effect (col. 1, line 64-col. 2, line 2). In response to this lack of success, Sugihara et al. proposes a hydrogen peroxide cleaning fluid containing a wetting agent in conjunction with a phosphonic acid chelating agent for decreasing the amount of metals adhering to a semiconductor substrate (col. 2, lines 19-24).

This chelating agent taught in Sugihara et al. necessarily includes at least two phosphonic acid groups ("the phosphonic acid chelating agent to be used is not limited particularly so far as it is a chelating agent having at least two phosphonic acid groups," col. 3, lines 31-34). Thus, Sugihara teaches away from using a chelating agent that does not include at least two phosphonic acid groups, since it states that other chelating agents have been unsuccessful in removing metals from semiconductor substrates.

The claimed chelating agent, conversely, does not require a phosphonic acid group. Rather, the preferred chelating agent in the claimed invention is 1,2-Diaminocyclohexane-N,N,N',N'-tetraacetic acid monohydrate (see application, paragraph [0034] and claim 13), which does not contain a phosphonic acid group. There is no suggestion in Sugihara et al. that such a chelating agent would be effective in removing metals from a wafer container, or any other object. On the contrary, Sugihara et al. teaches that only chelating agents containing at least two phosphonic acid groups are effective in removing metals from semiconductor substrates.

Woolsey et al., which was cited as teaching the use of 1,2-Diaminocyclohexane-N,N,N',N'-tetraacetic acid (DCTA), merely teaches that DCTA may be used as an additive to stabilize the temperature of an etchant mixture and to reduce the decomposition of H_2O_2 on metal layers of a substrate during etching (col. 3, lines 33-40). Woolsey et al. does not teach that DCTA can be used to remove metal from a wafer container, as claimed, but rather teaches that DCTA may be used to reduce the decomposition of H_2O_2 on metal layers of a substrate, and to better control the etching

process. Thus, Woolsey et al. is not directed to removing metallic contamination from a wafer container, or from any other object, and Woolsey et al. is therefore substantially unrelated to the claimed invention.

Thus, neither Sugihara et al. nor Woolsey et al. can properly be combined with any other reference to yield a method of removing metallic contamination from a wafer container using a solution including a chelating agent. Accordingly, it is submitted that all of the claims are in condition for allowance, and a Notice of Allowance is requested.

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